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(71) Applicant *(for all designated States except US)*: PUROPTIX [US/US]; Suite C, 1945 Camino Vida Roble, Carlsbad, CA 92008 (US).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: HAVENS, Daniel [US/US]; 12130 Coldwater Court, San Diego, CA 92128 (US).

(74) Agent: HAGLER, James, T.; Fish & Richardson, P.C., Suite 500, 4350 La Jolla Village Drive, San Diego, CA 92122 (US).

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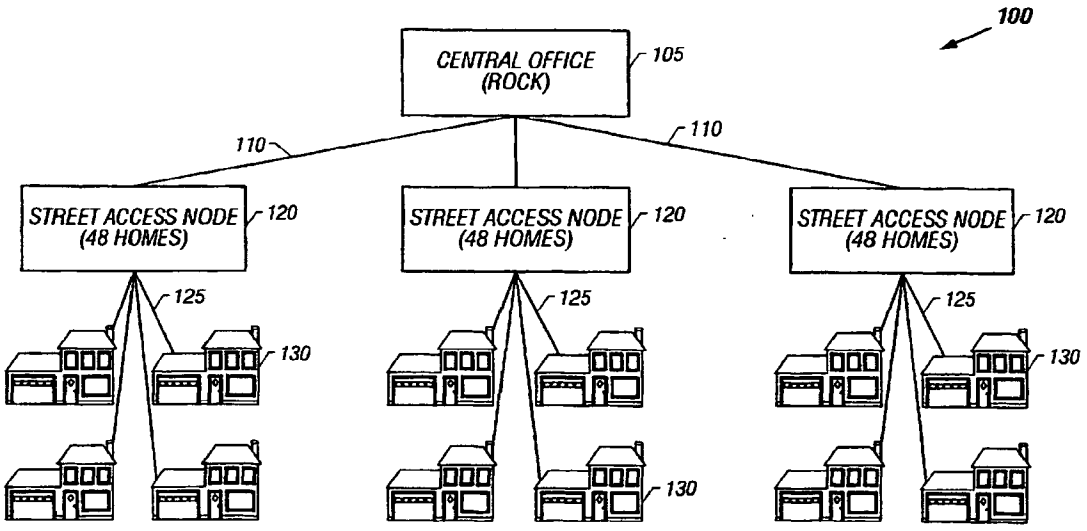
(54) Title: PURE OPTICAL INTEGRATED SERVICES NETWORK



(57) Abstract: An optical service network (100) delivers integrated services such as voice, video, and data to the home (130). A single termination device (130) is used for all services including local and long distance service, television and video services, high-speed Internet access, and other data services. A switch protocol facilitates interconnecting multicast virtual circuits at the content source to fixed unicast virtual circuits at the user premises. Each termination point (130) in the network (100) is connected to the operations center (105) with dedicated virtual circuits. Thus the system provides a rich diversity of services using uniform data transmission in a secure environment.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

PURE OPTICAL INTEGRATED SERVICES NETWORK

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of the U.S. Provisional Application No. 60/148,144, filed on August 10, 1999, which is incorporated herein by reference.

TECHNICAL FIELD

This invention relates to optical service networks, and more particularly to integration of an optical network into a single termination device.

BACKGROUND

In general, broadband telecommunications involves transmitting data over a wide or "broad" range of frequencies. Typically, fiber conductors or fiber optics, which transmit a broad range of frequencies, are used in broadband telecommunications applications as the preferred transmission medium. The advantage of broadband telecommunications is the ability to transmit large amount of data at high speeds. For example, broadband telecommunications permits transmission of digital video at rates sufficient to transfer full motion video.

Broadband telecommunications applications involve switching data at high aggregate bandwidth rates. For example, telecommunications systems employing fiber optics may require switching rates as high as several gigabits per second (Gbps). Broadband telecommunications systems, like traditional digital telephony systems, employ switching equipment to effectuate transmission of data from a source, such as a wide area network, to a destination, such as an end user's home or business. This type of broadband telecommunications switching equipment involves the transfer of data, at high speeds, within a "switching fabric." Data transfer, among components or subsystems in the switching fabric, requires operation in accordance with predetermined timing specifications or requirements. For example, transmission of data within broadband switching fabrics that support high aggregate bandwidth is measured in term of optical carrier rates. (e.g., OC-3, OC-12, OC-48 . . . OC-192). Accordingly, switching fabrics in broadband telecommunications require high speed data transfer.

The distribution of high bandwidth information, such as video, is frequently carried out over so-called hybrid fiber/coaxial (HFC) systems. These systems generally distribute the high bandwidth information in one direction

only. The fiber optics are connected to the head end of the system at the information source and transport a large number of individual signals or channels over the majority of the distance between the head end and the user locations. The fiber optics usually terminate at a point relatively close to a user location or group of user locations and are transported over coaxial cables from the termination point to the user location or group of user locations.

Fiber to the curb systems are similar to HFC systems in that fiber optics carry information from the head end to a point relatively close to a user location or group of user locations. The connection from the fiber optic termination point to the user location is typically a Digital Subscriber Line (DSL). Because of the relatively low bandwidth of a DSL connection, the services provided by such a system are necessarily limited. In particular, DSL systems are not well suited to the transmission of full motion, full resolution video services. Furthermore, the upstream transmission rate back into the network from the user is extremely bandwidth limited.

Passive Optical Network Systems (PONS) use

fiber optics from the head end to the user location. These systems transmit video as RF modulated analog signals. In this sense, PONS are no different than standard coaxial cable systems. The number of channels transmitted is limited by the available RF bandwidth and all channels are broadcast to all users. Video services such as pay-per-view require encryption devices at the head end and decryption/conditional access devices at the user premises. Video services such as video on demand cannot be efficiently implemented due to the broadcast nature of the system. In addition, data such as phone service and Internet are broadcast to a group of users. Upstream bandwidth is shared among the same group of users. This leads to security issues and bandwidth limitations.

SUMMARY

The present invention is an optical service network for delivery of integrated services such as voice, video, and data to residential and commercial customers. A single termination device is used for all services including local and long distance service, television and video services, high-speed Internet access, and other data services. A switch protocol facilitates interconnecting

multicast virtual circuits at the content source to fixed unicast virtual circuits at the user premises. Each termination point in the network is connected to the operations center with dedicated virtual circuits. Thus the system provides a rich diversity of services using uniform data transmission in a secure environment.

DESCRIPTION OF DRAWINGS

These and other features and advantages of the invention will become more apparent upon reading the following detailed description and upon reference to the accompanying drawings.

Figure 1 illustrates an integrated optical service network according to one embodiment of the present invention.

Figure 2 illustrates the regional operations center according to one embodiment of the present invention.

Figure 3 illustrates dedicated virtual circuits according to one embodiment of the present invention.

Figure 4 illustrates the connections between the network termination device and the end user devices according to one embodiment of the present invention.

DETAILED DESCRIPTION

The present invention is a Pure Optical Integrated Services Network (POISN). POISN is a high-speed optical network designed for cost effective delivery and access to integrated services including telephone services, television services including high definition television, video services, Internet access, and any data services. POISN uses standard Asynchronous Transmission Mode (ATM) transport over fiber optic cables. ATM is a switching and transmission technology that can process and transmit any type of information including data, text, audio, and video at high bit rates with a guaranteed quality of service.

Figure 1 illustrates an integrated optical service network 100 according to one embodiment of the present invention. The network 100 includes a central office 105 such as a regional operations center, a plurality of street access nodes (SAN) 120, and the terminal points 130. The central office 105 is connected to the street access nodes 120 via fiber optic cabling 110. In one embodiment of the invention, the connections are made using an OC-12 carrier rate. Of course, other carrier rates may be used without departing from the spirit of the invention.

Each SAN 120 is capable of supporting a plurality of terminal points 130. An example of a terminal point 130 is a house. Of course, other terminal points 130 may be used, such as office buildings or wireless centers. In one embodiment of the invention, each SAN 120 is capable of supporting up to 48 terminal points 130. The SAN 120 is connected to the terminal points via a communication path 125. The communication path 125 may be a fiber optic cable using an OC-3 carrier rate.

Figure 2 illustrates a regional operations center 200 according to one embodiment of the present invention. The regional operations center 200 collects all the information to be broadcast over the network 100. The center 200 may include data feeds such as a public switched telephone network 205, a network digital feed 210, local digital video feeds 215, other digital video service providers 220, video on demand servers 225, and an Internet connection 230. Of course, other data sources may also be accumulated at the center 200. The Internet connection 230 may be run through a router 235 to ensure proper distribution of Internet data. The data feeds are connected to a provider interface switch 240. There may be a plurality of provider interface switches 240 depending on the number of data feeds.

The provider interface switches 240 are connected to a main switch 245 via a fiber optic connection using an OC-48 carrier rate. Of course, other carrier rates may be used for this connection. A program guide server 250 may also be connected to the main switch 245. The program guide server may be connected to a system database 255 to obtain guide information.

A network manager 260 is also connected to the main switch 245. The network manager 260 includes system software designed to control the network 100. The network manager 260 controls the data flow over the network 100 and provides for functionality including provider and service selection, permissioning and provisioning of services selected, circuit setup and coordination with switching equipment, and data collection of online transactions for billing, historical, and marketing purposes. In one embodiment, the network manager may include software running on a SGI Origin processor using the UNIX operating system. Of course, other processors and operating systems may be used. With the SGI Origin processor, the network manager is capable of supporting approximately 38,400 subscribers. If additional subscribers are desired, additional processors may be added.

The main switch 245 controls the data to be distributed over the network 100. The main switch 245 includes operating software that comprises modified ATM, customized vendor software, and other additional software as necessary. The main switch 245 connects multicast virtual circuits to unicast virtual circuits. This allows for fixed circuit assignment between the center 200 and the terminal points 130. The main switch 245 also permits fast circuit setup times when a subscriber selects a video service or channel for viewing. The main switch 245 couples a multicast feed from a service provider to individual subscriber circuits that provide a permanent connection from the center 200 to the terminal points 130. The main switch 245 communicates with the SANs 120 via fiber optic cabling 110.

Figure 3 illustrates the concept of dedicated virtual circuits used in the optical service network according to the present invention. POISN uses standard Asynchronous Transmission Mode (ATM) transport over fiber optic cables 330. Each fiber optic cable 330 is capable of carrying multiple data streams 310, 315, 320, 325 using virtual channels 335. The virtual channels 335 are realized using time division multiplexing according to the ATM standard. The termination devices 305 may transmit and

receive data streams 310, 315, 320, 325 on a number of virtual channels 335. At the ATM switching device 340, data is received from a virtual channel 335 on one fiber optic cable 330 and retransmitted on one or more virtual channels 335 on the same or different fiber optic cable 330 as directed by the network manager 260. The retransmission of data through one or more ATM switching devices 340 creates a dedicated virtual circuit from one termination device 305 to another.

Each service requested by the end user is carried over a dedicated virtual circuit from the center 200 to the terminal point 130. For example, if the user is viewing a video service and talking on the telephone, the video service is being transmitted over a first virtual circuit and the telephone service over a second virtual circuit. If the user requests a new channel for the video service, the main switch 245 sends the new channel over the virtual circuit. Thus, the center 200 controls the information being transmitted to the terminal point 130, and only the requested information needs to be transmitted. Therefore, the present invention provides for an efficient transfer of information between the center 200 and the terminal point 130.

Figure 4 illustrates the connections 400 between the network termination device 405 at the terminal point 130 and the end user devices. The terminal point 130 includes a network termination device called a POD 405. The POD 405 consists of an ATM interface connecting the service network to the home wiring. The POD 405 includes several ATM subsystems to connect to devices throughout the home, including a voice subsystem 410, a low-speed serial subsystem 420, a video subsystem 425, and an Ethernet/Internet protocol subsystem 435. The POD 405 receives data from the network via the communications path 125. The communications path 125 may be a fiber optic cable using an OC-3 carrier rate. The entire network may operate symmetrically, providing equal bandwidth in both directions between the central office 105 and the terminal points 130.

The POD 405 provides telephone service to the house via the voice subsystem 410. The voice subsystem includes ATM conversion components which provide conversion for the ATM circuits and a plurality of traditional analog telephone RJ11 ports. In one embodiment, the voice subsystem may include three telephone service ports.

The POD 405 also provides for a connection to the low-speed serial subsystem 420 and the Ethernet/Internet

protocol subsystem 435. The low-speed serial subsystem 420 provides ATM conversion for low speed serial I/O on standard serial interfaces such as an RS-232 connection. The Ethernet/Internet protocol subsystem 435 is an ATM to TCP/IP interface associated with an Ethernet controller component that delivers service via a standard RJ45 interface to in-home network cabling.

The POD 405 further includes a video subsystem 430. The video subsystem 430 provides an interface to a plurality of set-top boxes 425. The video subsystem 430 may be connected to the set-top boxes 425 via standard RG-59 in-home coaxial cabling. In one embodiment of the invention, the video subsystem 430 uses a Quadrature Amplitude Modulation (QAM)/Digital Synchronous Terminal (DST) link to communicate with the set-top boxes 425. Each set-top box 425 may include a web browser and a video decoder. The video decoder may operate using MPEG decoding. The user interacts with the network through the set-top boxes 425 using an interactive user interface. The interface may be displayed on a television or computer monitor and may be controlled via a remote control device. The actual "Program Guide" and system software may reside on the program guide server 250. The use

of set-top boxes 425 and "Program Guides" are well known in the art and will not be described in detail herein.

Numerous variations and modifications of the invention will become readily apparent to those skilled in the art. Accordingly, the invention may be embodied in other specific forms without departing from its spirit or essential characteristics.

WHAT IS CLAIMED IS:

1. A method of providing integrated services comprising:

collecting a plurality of services at a network center;

determining the services requested by a remote location; and

transmitting the services over a dedicated channel to the remote location.

2. The method of Claim 1, further comprising transmitting the services over an ATM network.

3. The method of Claim 1, further comprising connecting the requested services to the dedicated channel.

4. The method of Claim 1, wherein the services include video services.

5. The method of Claim 1, wherein the services include Internet services.

6. The method of Claim 1, wherein the services include.telephone services.

7. The method of Claim 1, wherein the dedicated channel may be fixed or switched.

8. The method of Claim 1, further comprising receiving the services at a terminal box at the remote location.

9. The method of Claim 1, further comprising distributing the services at the remote location using the terminal box.

10. The method of Claim 1, wherein the services are transmitted over fiber optic cables.

11. A method of delivering data comprising:

collecting a plurality of data types

determining the data type requested;

establishing a dedicated channel; and

connecting the requested data type to the dedicated channel.

12. The method of Claim 11, further comprising transmitting the data type to a remote location.

13. The method of Claim 11, wherein the dedicated channel is on a fiber optic cable.

14. The method of Claim 11, wherein the dedicated channel is a virtual circuit.

15. The method of Claim 11, wherein the plurality of data types includes video, telephone, and Internet data.

16. An optical integrated service network comprising:

a network center which collects a plurality of data signals;

fiber optic cabling which connects the network center to a remote location;

a main switch which connects the plurality of data signals to a dedicated channel within the fiber optic cabling;

a reception terminal at the remote location which receives the data from the fiber optic cabling; and

a selection device which requests the data signals to be connected.

17. The optical integrated service network of Claim 16, wherein the network is an ATM network.

18. The optical integrated service network of Claim 16, wherein the main switch connects to the data signals in response to a request from the selection device.

19. The optical integrated service network of Claim 16, wherein the data signals include video services.

20. The optical integrated service network of Claim 16, wherein the data signals include Internet services.

21. The optical integrated service network of Claim 16, wherein the data signals include telephone services.

22. The optical integrated service network of Claim 16, wherein the dedicated channel may be fixed or switched.

23. The optical integrated service network of Claim 16, wherein the reception terminal distributes the data signals throughout the remote location.

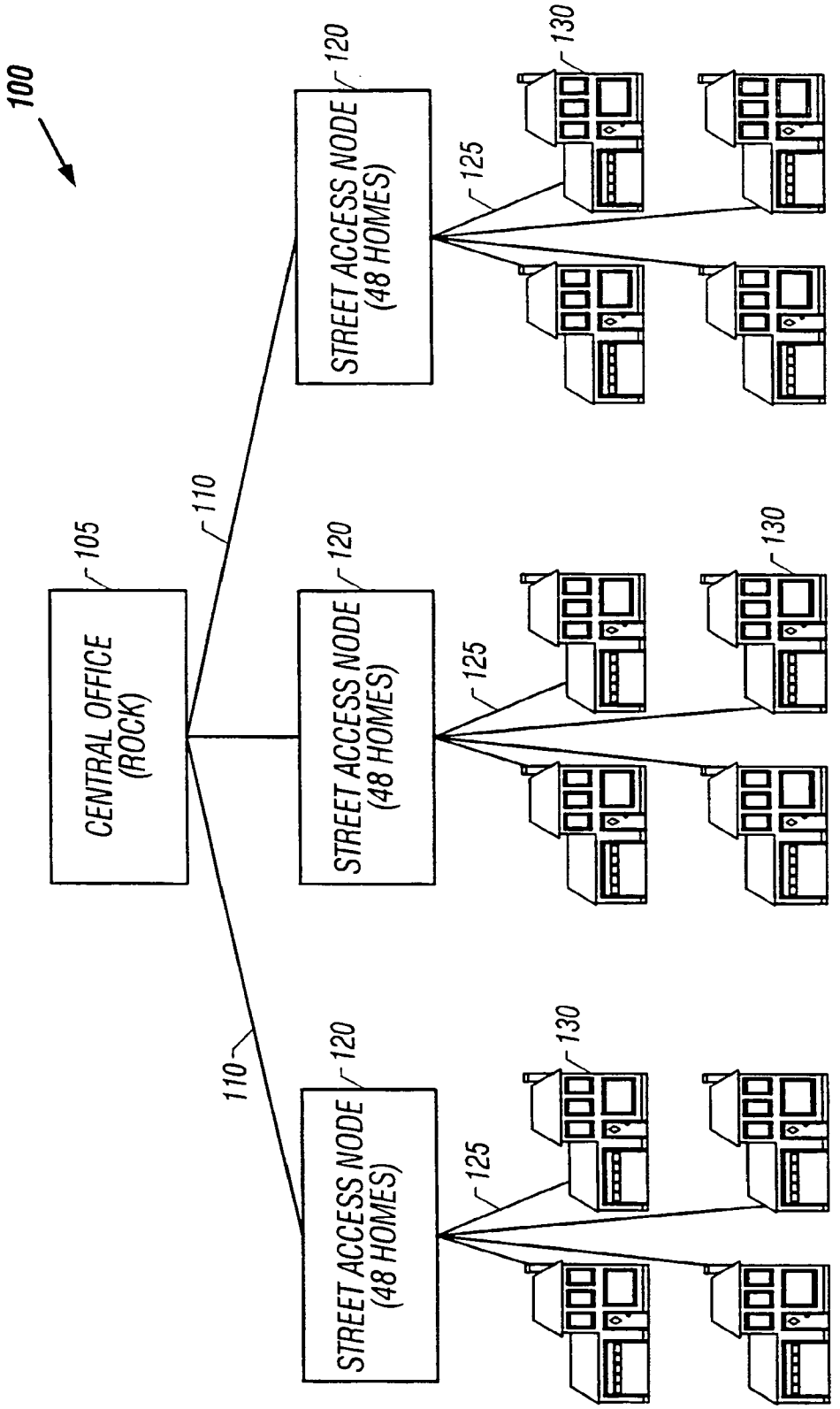

FIG. 1

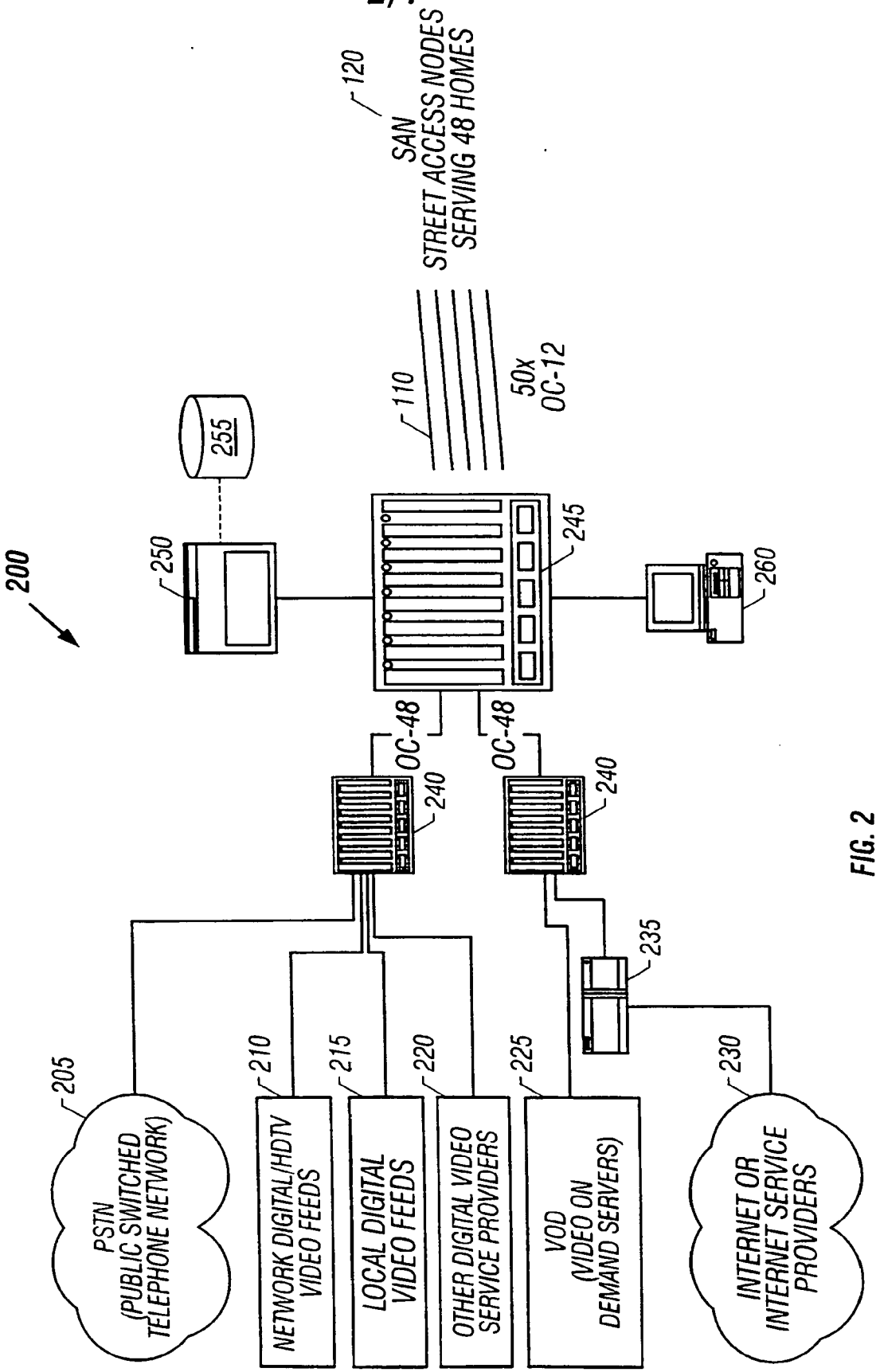

FIG. 2

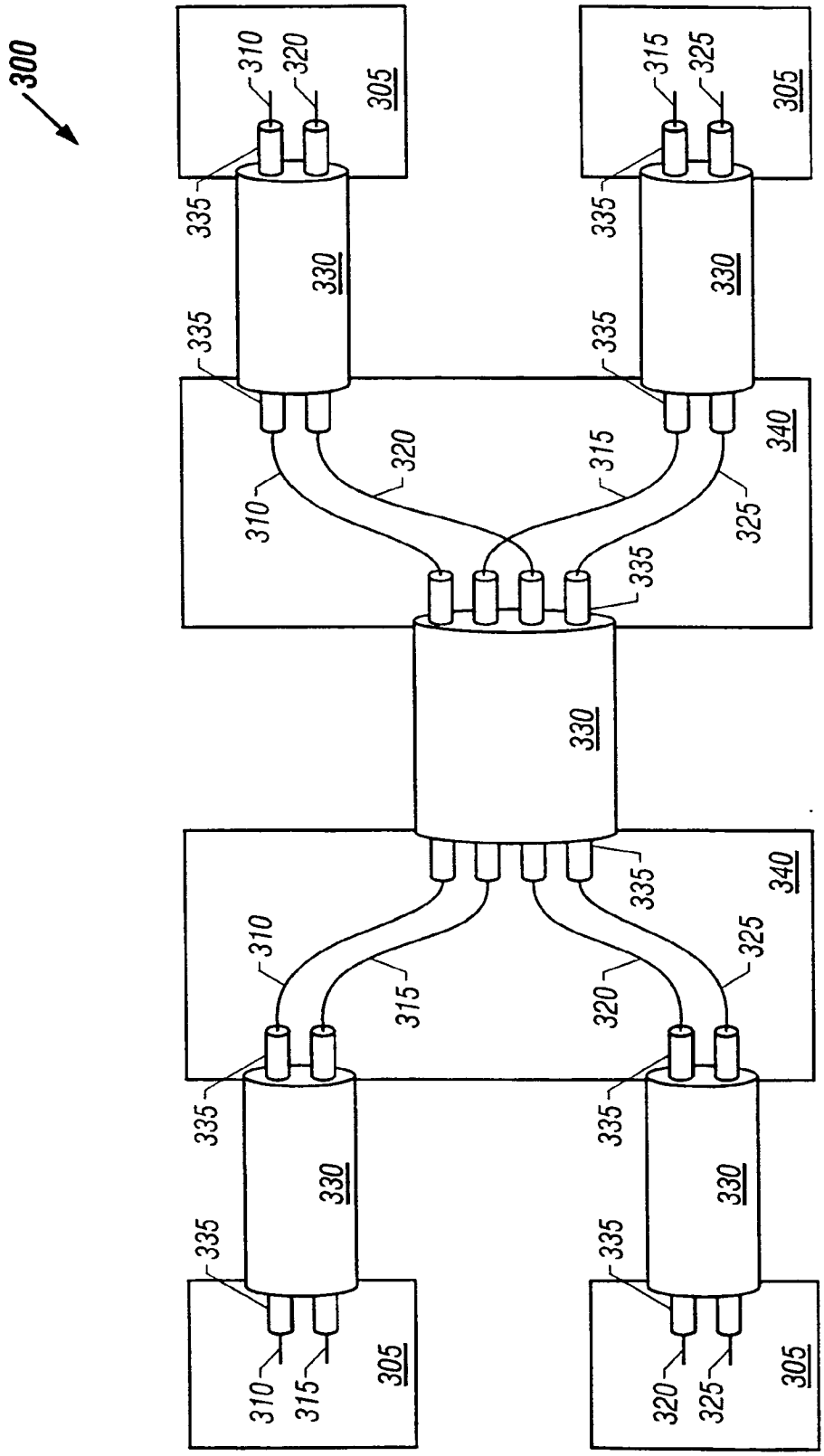

FIG. 3

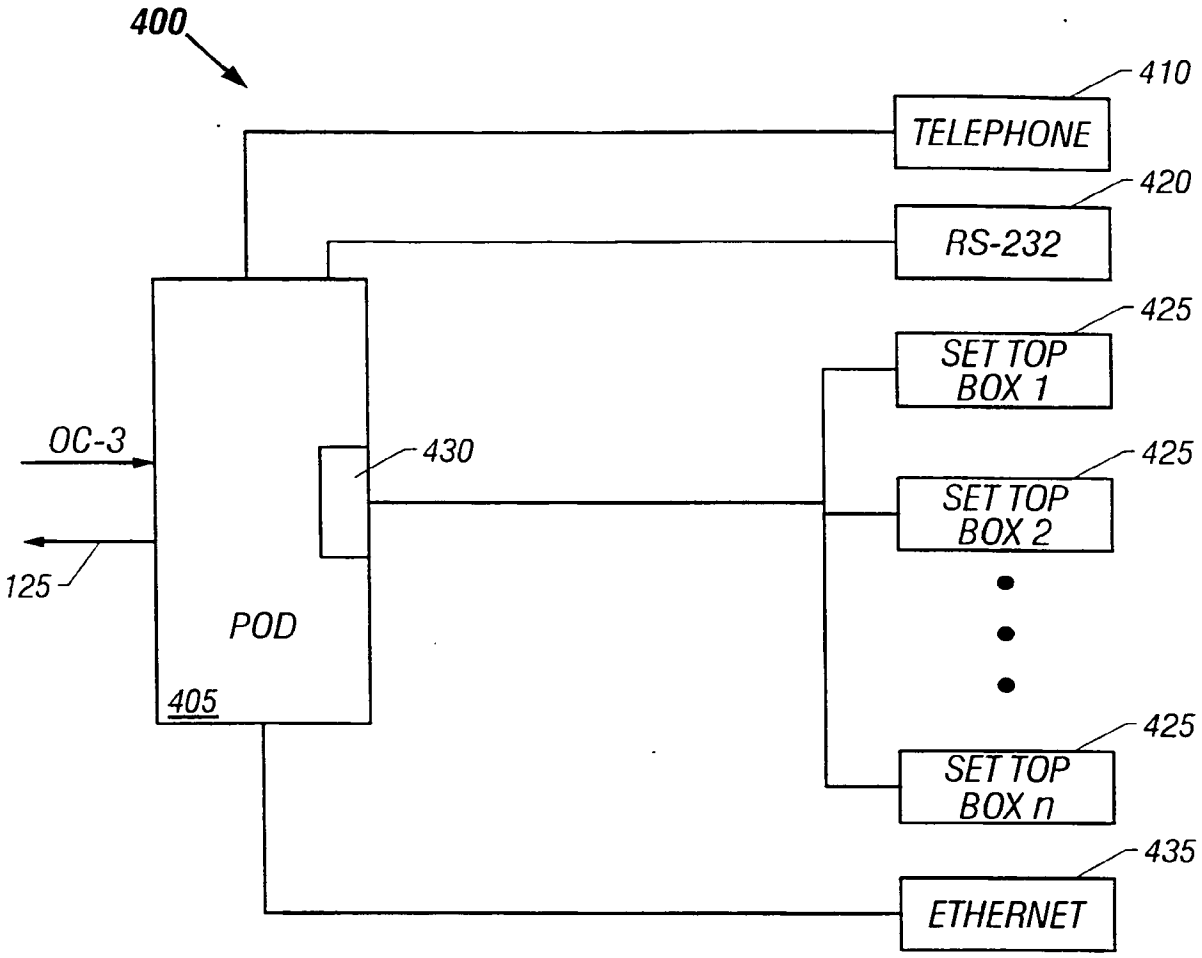

FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/21925

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :H04H 1/04
US CL :370/486

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 370/352, 353, 395, 486, 487, 493; 348/7, 8, 12, 14, 16

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

none

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EAST
search terms: telephone or phone or pstn, optic$3 or fiber or fibre or sonet, Internet, settop or "set-top" or "set top", atm

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,805,804 A (LAURSEN et al.) 08 September 1998, figs. 1, 4, & 5.	1-23

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
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